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DIGITAL MAP –URBAN DEVELOPMENT SUPPORT

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Abstract: In the current context of living and production spaces expansion, of great diversification of population mobility in both the adjacent urban and rural space, the large amount of geospatial data can only be managed in digital maps integrated in GIS (Geographic Information System). Thus, there is a need to implement modern solutions based on specialized hardware and software for optimal management of this data. The direct beneficiaries of digital maps managed in GIS are the various specialized departments of the local public administration to solve problems, issue solutions, make optimum decisions and inform the population. Digital maps are the pillar of urban, metropolitan or regional planning solutions. There are currently a number of digital maps available online, which is the focus of this work. The most used digital maps are presented in detail.

Keywords: digital map, urban development, GIS, conservation.

1. INTRODUCTION

Nowadays, the most important task of the new cadastral policy is to ensure the informatization of this activity, related to the general cadastre and specific information systems: of water, for land reclamation and improvements, agricultural, real estate, building, public roads, of railways, airports, ports, for metro, forestry, viticulture, industrial, mining, oil, historical monuments, protected areas, to ensure a complete record of land and buildings to design the territory in a convenient and consistent way according to sustainable development policies.

The market availability of the various solutions that, along with the topographical measurements, are the basis for the development of plans and digital maps lead to a modern cadastre that can meet the current requirements in this field of activity.

The current trend in the manner maps are produced involves web mapping due to the dynamic needs of users for interactivity with mapped geographic features, but also due to the widespread use of GIS (Geographic Information Systems) to produce digital maps [1,2]. This cartographic visualisation process can be a geospatial conversion of database data into cartographic products. The role of the specialist is to study the geospatial data and produce the maps, which are seen as a means of communication. The digital maps produced can have many further uses. Research or exploration cannot be carried out without an expert in the field. Thanks to his knowledge, he can produce a map, even if the data is at an unknown stage. Through software or some other means, a graphic expertise is provided. The exploration of the world, to a large extent, has been determined by classical cartography, which has one of the most important roles [3]. Current web applications containing maps are largely free applications, but there may also be applications for which users are charged a fee. Another problem with these applications is that they need to be kept under constant review, as they need to be updated with new data and routes. Traffic maps give users information and details about road travel and communication routes. These traffic maps can be divided into two categories; therefore, there are maps containing information regarding existing traffic and maps that contain information strictly only on routes.

A good example of a digital map application is Google Maps, which is widely used on mobile phones or can even be implemented in transport equipment. This application provides information on the route, speeds and times. With this application, users have the opportunity to find the shortest route with the lightest traffic, as this website has the ability to recalculate routes, travel times and speeds, depending on the level of traffic (which can be very busy or traffic can be stopped on a certain route). At the heart of this application is a well-controlled and well-developed infrastructure that provides this information to ordinary users. This is made possible by an information infrastructure consisting of high-performance computers, road sensors, webcams and traffic counters, through which traffic information and images are transmitted. The maps are equipped with specific symbols.

2. DIGITAL MAPS

2.1 Google Maps

Google Maps is a free mapping application that can be accessed at http://maps.google.com. Its history begins with Google's acquisition of Where 2 Technologies in late 2004.

With Google Maps one can see roads all over the world, traffic directions, traffic information such as streets closed to traffic or under repair, accidents and more. The application is very useful when users want

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to find the distance between two or more points on the map and avoid motorways or toll roads. Google Maps provides valuable driving directions and suggests various routes which are expressed in km or miles depending on one's preferences, as well as the approximate duration of these routes.

It specialises in online mapping of the globe and allows users to view maps, satellite photos of the Earth's surface and even return lost objects.

There are three different ways to view maps: Map, Satellite and Terrain. Whichever mode is chosen if the user positions the cursor over the "More..." button they can add items such as photos, video, webcams and/or information to the map. Thus, in addition to the "usual" search, one can search for companies, addresses and locations of interest.

The Street View feature displays 360° panoramic images of several cities around the world on the screen. As time goes by, Google aims to capture street images from every country in the world.

Users can add new roads or buildings not yet shown on the map. This is done by pencilling in the road, most accurately when you have a GPS-recorded route that doesn't yet exist on the map. It must be approved before it appears on the map.

The advantage this application offers is that the phone it is installed on doesn't necessarily have to have a GPS receiver like GPS navigation devices. The disadvantage, however, is that the maps load directly from the Internet so when you want to use the application you need to be connected to the Internet. This is possible (for free) in hotspot locations if your phone has Wi-Fi or directly via 3G/4G/5G.

This application is so well maintained that images that are more than 3 years old cannot be found (Figure 1).

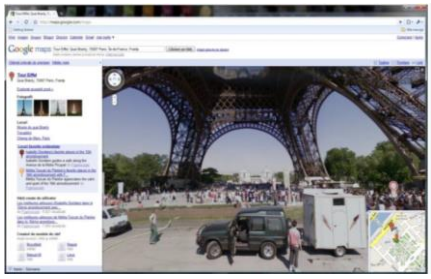

Figure 1. Paris Eiffel Tower in Google Street View [4]

2.2 Google Earth Pro

Google Maps and Google Earth Pro are completely different applications. Google Earth Pro allows users to scroll back through the historical timeline. This way, one can interactively view previous satellite maps for any location in the world. Long ago, this was a paid feature, but now it is completely free (Figure 2).

Figure 2. Image from Google Earth Pro [5]

2.3 NASA Worldview

NASA's world view aims to deliver real-time images, a true representation of Earth today. NASA Worldview displays over 800 layers of satellite images, and most of them are usually only 3 hours delayed (Figure 3).

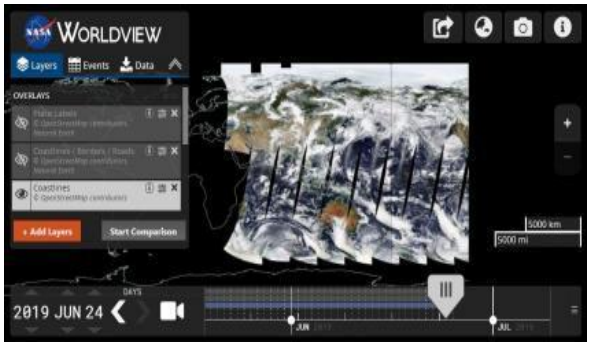

Figure 3. Image taken from NASA Worldview [6]

2.4 Mapbox

Mapbox eliminates clutter and focuses more on the clarity of satellite imagery. When the application is accessed, users choose the satellite view, as the zoom in function is used, high resolution and quality satellite maps can be seen. It includes images from the most iconic commercial satellites, such as DigitalGlobe (Figure 4).

Figure 4. Image from Mapbox [7]

2.5 Esri World Imagery

Esri takes images from over 300 collaborators around the world. The result is a global image layer that is one of the most powerful and up-to-date base maps available today. Quickly and efficiently, satellite maps can be viewed at resolutions up to 3cm in pixels. It is the size of a small pebble (Figure 5).

Figure 5. Extract from Esri World Imagery [8]

2.6 Esri Wayback Atlas

This application is Esri's image atlas, it is like going through a time machine. Similar to Google Earth Pro, users can selectively choose from satellite maps back in time. This atlas holds a lot of secret information like New York has over 100 satellite maps dating back to 2014 (Figure 6).

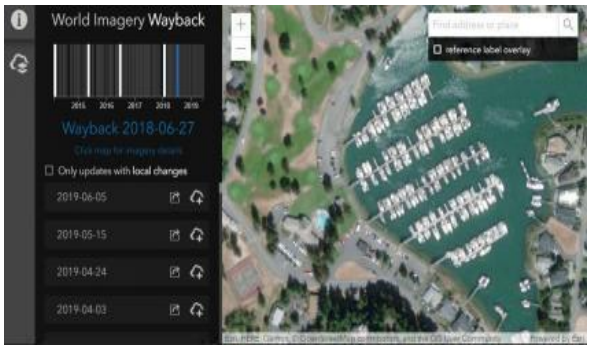

Figure 6. Extracts from Esri Wayback Atlas [9]

2.7 Bing Maps

Bing's street views are sparse and not oblique views like Google Maps. Bing Maps offers over 10TB of images, although some images may be years out of date, populated areas have frequent updates (Figure 7).

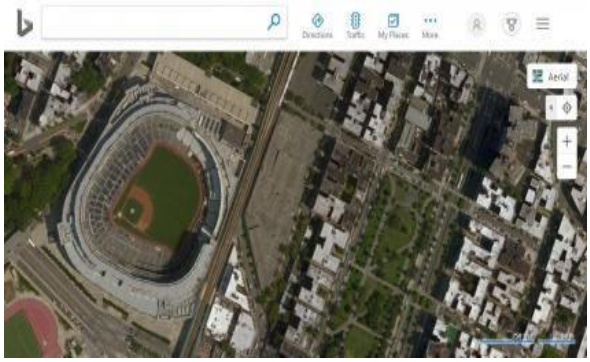

Figure 7. Extracts from Bing Maps [10]

2.8 HERE Maps

As a company, HERE focuses on navigation, traffic patterns and self-driving cars. But as part of its platform, it provides satellite maps for drivers (Figure 8).

Figure 8. Extracts from Here Maps [11]

Here WeGo application functionality: provides users with various navigation maps of over 1,900 cities worldwide. This allows users to travel internationally guided by HERE WeGo, which works even when the mobile device is not connected to an internet network. The application also allows address search including by street number and integrates a parking space search function for people travelling by car (Figure 9). Thus, in almost a century of evolution, the navigation application has its origins in the Nokia labs and now exists as Here Global BV, under the automotive concerns Audi AG, BMW AG and Daimler AG.

HERE WeGo is a mapping and web navigation service operated by Here Technologies and originally developed by Nokia. In 2013, HERE Technologies launched this web mapping application for Windows Phone and the World Wide Web as a revamped version of Nokia Maps. HERE Technologies launched the HERE Maps app on the Android platform on 10 December 2014 and subsequently for iOS on 11 March 2015. The company changed the product name to Here WeGo in July 2016. It is the default provider of map services for Amazon Fire tablets and smartphones. This makes it the first map service to offer both turn-by-turn navigation with voice directions and pedestrian navigation, including using public transportation. In fact, the application is used as a source for Microsoft's Bing Maps service and includes over 1,300 cities with advanced navigation features.

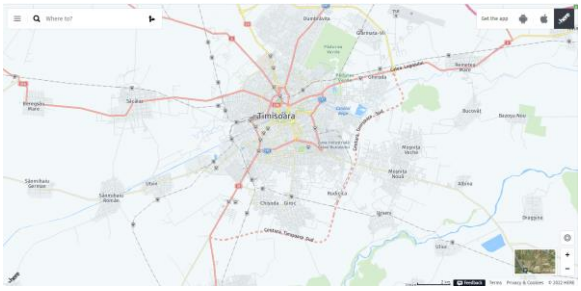

Figure 9. Screenshot from Here WeGo app [11]

In addition to walking, car and public transport routes, HERE WeGo can even offer the ability to plan a route for taxis, ridesharing services and bicycles. Certainly, these features that benefit from real-time updates need the internet, but HERE WeGo also works offline.

HERE WeGo is based on the HERE platform, a fully integrated location data platform. HERE Technologies has provided its internal data, which includes satellite views, traffic data and other location services. Maps are updated every two to three months. Works on all major browsers. Users can organize their favourite places into collections and sync with mobile devices. The web application also uses WebGL to provide 3D views of maps without a plugin. With 3D glasses, users can get stereoscopic views of 25 cities. It also provides detailed street-level images for many cities. As of 2013, the website offers routing support between many landmarks, city pages for over fifty popular cities showing local time and weather conditions, along with Lonely Planet information and suggested places, 3D maps of 25 cities with routing support. Live traffic flow view. Public transport search, synchronization of user points of interest (Collections) between website and mobile device, heat maps visualizing popular areas for food, nightlife,

shopping and local attractions in selected cities, listing and managing businesses.

HERE WeGo provides step-by-step navigation in both offline and online modes. Users can enter a destination address, landmark or company name, then the app automatically calculates directions and distance to the destination. Real-time traffic data (where available) is also taken into account and a prediction is made of the time of arrival at the destination.

Depending on the smartphone model, HERE WeGo offers pre-recorded navigation voices as well as text-to-speech commands with street names.

Public transport data is displayed by the Here app while one plans a route while online for transport options such as buses, trams, subways and trains. Walking and cycling routes are also supported. Time and distance estimates are provided for these modes and driving navigation.

2.8. Planet Explorer

Planet Explorer is like a satellite map goldmine, because it not only shows satellite maps from over 120 microsatellites, but almost daily updates are transmitted at 2.5m resolution. There is one drawback: first users have to register an account, the app is free for the first 15 days, but after that it's against payment (Figure 10).

Figure 10. Extract from Planet Explorer [12]

2.9 MapQuest

MapQuest uses the services of TomTom, an application that offers a mixed package of images. MapQuest was popular in the 1990s (Figure 11).

Figure 11. Extracts from MapQuest [13]

2.10 Yahoo! Maps

Yahoo! Maps has been gone since 2015. Yahoo has had a legitimate 8-year run, yet somehow, it still hasn't stopped. Its satellite maps are lagging behind its competitors in many ways. For example, it lacks 3D updates, street views and imagery (Figure 12).

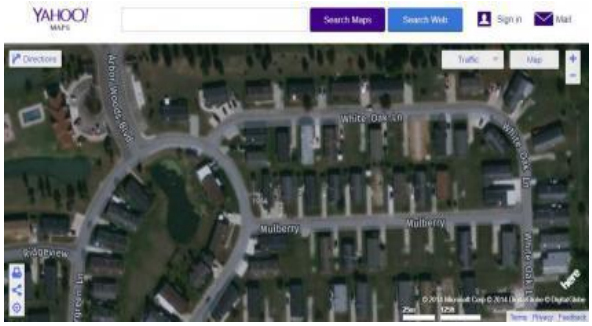

Figure 12. Extracts from Yahoo Maps [14]

2.11 MDA NaturalVue

For a coarse view of the Earth, MDA NaturalVue has a resolution of 15 metres. NaturalVue is an old app, but it's a real success if you need to render coherent images of the world (Figure 13).

Figure 13. Extracts from MDA NaturalVue [15]

2.12 Landsat Explorer

The launch of Landsat-1 in 1972 was a milestone for space satellites. It was a watershed moment that determined the more than 40 years of archiving our planet's history. Hundreds of satellites have followed the Landsat path into space.In Landsat Explorer, new modes can be seen, such as near infrared, a spectral index or as our eyes see it (Figure 14).

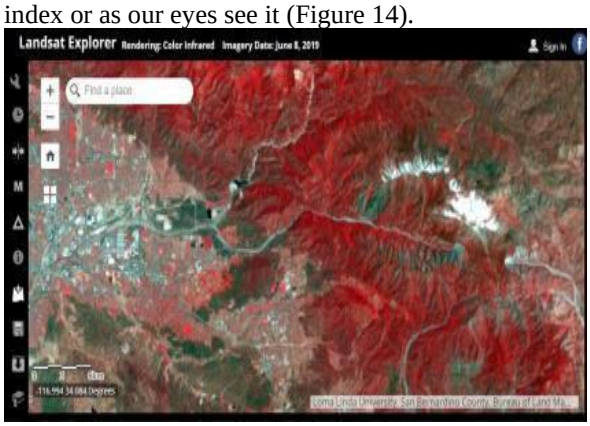

Figure 14. Extracts from Landsat Explorer [16]

2.13 Sentinel Playground

The truth is that satellite maps aren't just for pretty pictures. For example, the 12 indices in Sentinel Playground characterise different features of the Earth (Figure 15).

Figure 15. Extracts from Sentinel Playground [17]

2.14 USGS Earth Explorer

USGS Earth Explorer offers users over 45 satellite platforms to navigate. No data download is required, you can simply preview online. It is the only source where hyperspectral imagery is viewed on the fly. Not only that, but spy satellites like CORONA from the 1960s can be unlocked.Overall, USGS Earth Explorer is revolutionizing the way satellite maps are viewed because seeing is believing (Figure 16).

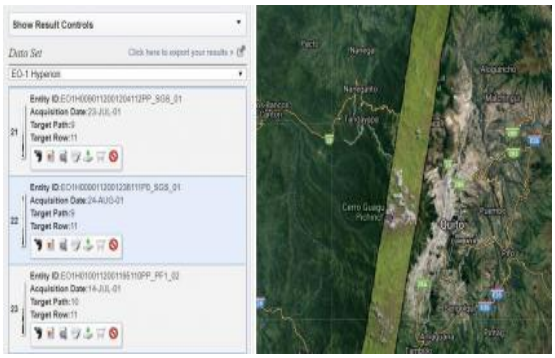

Figure 16. Extracts from USGS Earth Explorer [18]

2.15 Leaflet

Leaflet allows anyone to create easy web maps and allows users to name them under their own names. Leaflet has a wide range of free map providers. For example, Esri, Geoportal France and CartoDB are all found there. An interesting feature is that when the user scrolls, it interactively updates the map of each provider (Figure 17).

Figure 17. Extracts from Leaflet [19]

2.16 Cesium

Similar to Leaflet, Cesium allows users to build their own custom web maps. Cesium is a 3D representation application. The Cesium viewer is joined by satellite maps such as Bing, Esri and Mapbox (Figure 18).

Figure 18. Extracts from Cesium [20]

2.17 Tomnod/GeoHIVE

Tomnod harnesses the power of crowdsourcing in times of crisis. For example, Tomnod is best known for its platform search for flight MH370. After 9 years and miles of satellite imagery, DigitalGlobe is switching the Tomnod platform to GeoHIVE(Figure 19).

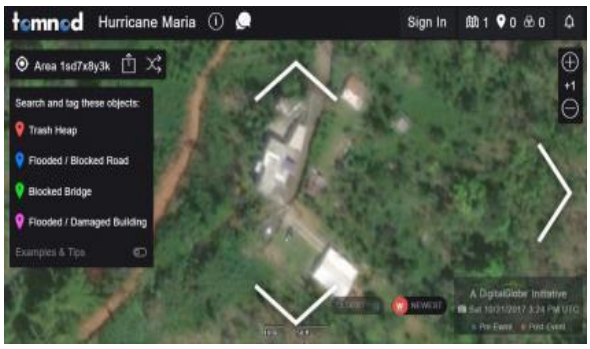

Figure 19. Extracts from Tomnod/GeoHIVE [21]

2.18 DigitalGlobe Open Data

DigitalGlobe has two open data options: first, its open data program supports major global crisis events such as earthquakes, hurricanes and forest fires. This way, those in need can get the support they need. During these humanitarian events, they release each photo into the public domain under a Creative Commons 4.0 license. Second, DigitalGlobe has product samples available around the globe. For example, sample product images are available for Rio de Janeiro (Brazil), Stockholm (Sweden) and Washington DC (USA) (Figure 20).

Figure 20. Extracts from DigitalGlobe Open Data [22]

2.19 NOAA Weather Radar

In this global map, weather from space is transmitted in near real time (Figure 21).

Figure 21. Extracts from NOAA Weather Radar

2.20 GOES Viewer

GOES provides weather information. These geostationary satellites update the weather every 5 minutes. You can view the weather by following these steps: first go to the GOES Imagery Viewer, then select the target region. This leads to the view of the maps taken from the satellite. Finally, choose the desired view option and get an up-to-date snapshot of the weather from the satellite (Figure 22).

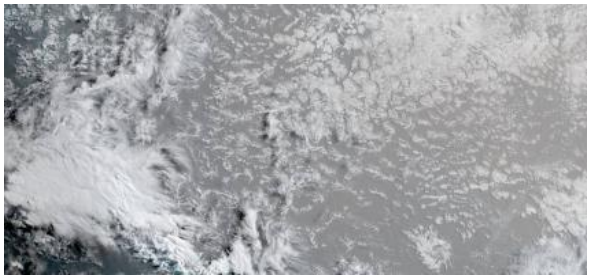

Figure 22. Extracts from GOES Viewer [23]

2.21 Latest 24

As NOAA satellites circle the Earth, a preview of our planet from space is obtained. Instead of a 3D perspective, NOAA has built a set of satellite maps that look at the weather from a top-down view. In fact, you can quickly scroll back and forth interactively through the weather over the past 24 hours each day (Figure 23).

Figure 23. Extract from Latest 24

2.22 Night View

Over 400 images from space, NASA has formed the most comprehensive night view on its black marble-like map. As can be seen in this night view map, large cities light up the sky the most. Overall, this gives a basic figure for how long mankind has lived on earth (Figure 24).

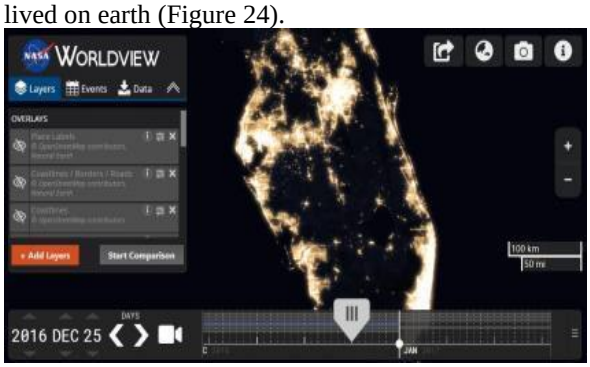

Figure 24. Extracts from Night View

2.23 Global Forest Map

When a tree falls in the forest, satellites hear the impact. Anyone who doubts the severity of deforestation can look it up in Global Forest Watch. By default, deforested forests are activated. Countries like Indonesia, Brazil and Peru are lighting it up (Figure 25).

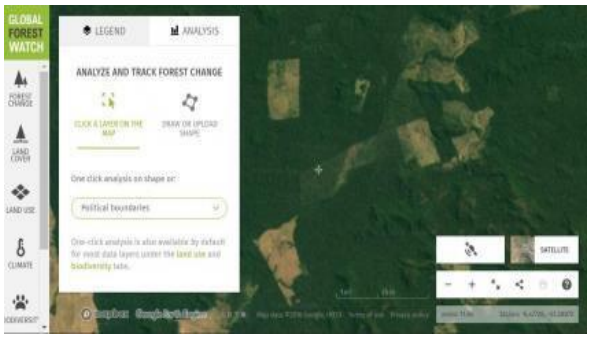

Figure 25. Extracts from Global Forest Map

2.24 NASA's Fire Information for Resource Management System (FIRMS)

When wildfires occur, satellites track where they are burning. Specifically, they capture vegetation fires as they happen and transmit them via active fire maps such as FIRMS. Yet there's a curious disconnect among those fighting fires on the ground.

Satellite sensors like MODIS and VIIRS use thermal infrared. Only then do they detect fires as small as a hot spot...until a volcanic eruption (Figure 26).

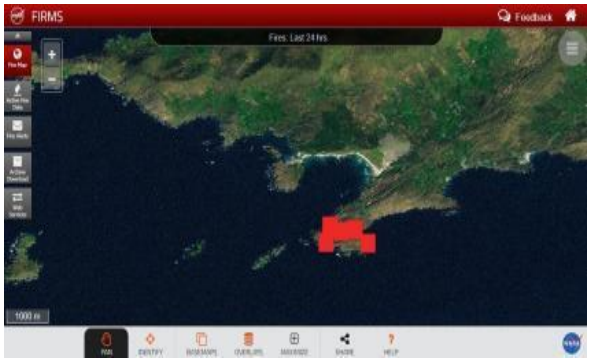

Figure 26. Extract from NASA's Fire Information Resource Management System (FIRMS)

2.24 WAZE

Waze is a revolutionary GPS navigation application for smart phone (smartphone) and tablet users. Unlike other navigation apps, the advantage of Waze is that it will get you to your destination by the fastest route, taking into account real-time traffic values. Waze is, at least at the moment, the alternative to TMC (Traffic Message Channel), but as there is no such thing in Romania, it is the only app that will provide users with real-time traffic data, and routes will be constantly optimised according to real-time traffic updates.

Waze can run on any Android and IOS smartphone, but requires a permanent internet connection. There is no subscription, everything is 100% free. Maps are usually updated daily. Sometimes, and as an exception, it can take several days.

Application features:

- full navigator with turn instructions with female voices in English;
- street name pronunciation (only for female voice Simona);
- real-time traffic situation thanks to user contributions;
- fuel prices that can be updated by users;
- the possibility to avoid toll roads, difficult roads and unpaved roads;
- with regular free updates to the map which is automatically downloaded and to which you can contribute;
- destination search by full address, category, location, coordinates, your favourites or a link sent by a friend;
- search for your destination using the Google database;
- support for Spotify, TuneIn, iHeartRadio, NRJ Radio and other audio apps for a more comfortable listening experience;
- multilingual support;
- management and notification of planned trips;
- ability to report speed cameras, construction sites, closures, hazards, speed cameras, etc.;
- connection to friends, identifiable from phonebook and Facebook;
- voice search commands;
- automatic screen brightness reduction to save battery power;
- customisable notification to avoid forgetting your child in the car;
- a choice between 'private vehicle' and 'taxi' mode;
- speeding warnings;
- connection with Facebook, Twitter and Linkedin.

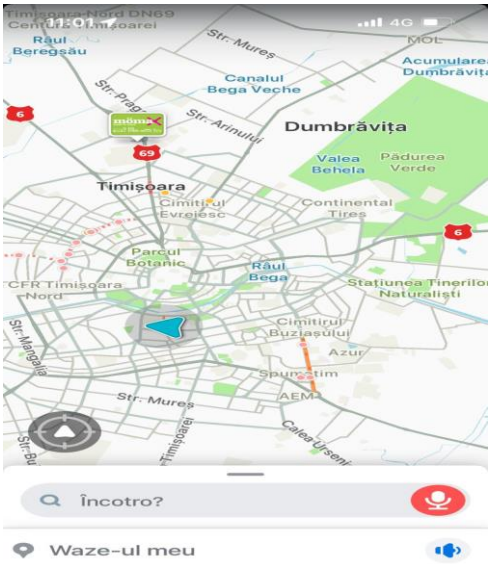

Figure 27. Screenshot from the Waze application

The Waze app, by simply using it while travelling - with or without a destination set in the app, even "idling" that is - automatically sends traffic values (average speed on the road segments being travelled) to the Waze servers and these servers analyse and process the data received from all the apps running, then based on all this traffic data it calculates the optimal routes for each individual application (client app), and the optimal route for each user is automatically pushed to all Waze users, even highlighting problem areas on the map. So, to avoid traffic jams, the app can even reroute you during your journey, not just once at the start, not just when you set your destination. Users can manually report traffic jams and other traffic hazards (potholes, risk of overtaking, faulty traffic lights, obstacles on the road, etc.), including places where police are present (e.g. speed cameras or filters) (Figure 27).

2.25 Satellites Pro

A digital map is available online at https://satellites.pro/. It does not provide navigation capabilities (Figure 28).

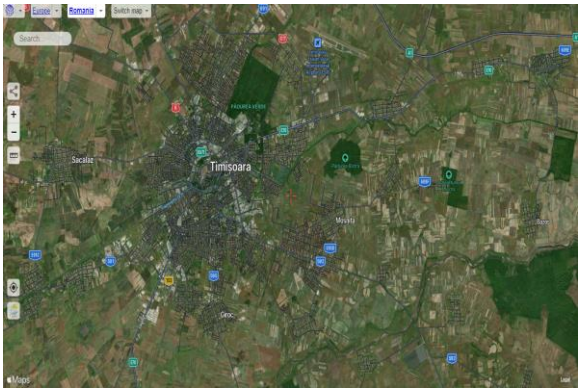

Figure 28.Screenshot with Satellites Pro digital map [24]

3. CONCLUSIONS

In many countries around the world, the lack of reliable mapping is a serious constraint to development in various sectors, particularly in the areas of rural and urban development and for the balanced planning, management, extraction and use of natural resources and the environment. Since sensor data from Landsat satellites became available in 1972, valuable information on the Earth's resources covering three decades has been made available to users. Today, digital maps resulting from satellite image processing are used in a variety of applications in many disciplines, such as agriculture, forestry, municipal or regional master planning, infrastructure planning or other activities where up-to-date geospatial data reflecting the actual situation and changes in the terrain are needed.

In today's context of expanding living and production space, of increasing diversification of population mobility in both urban and adjacent rural areas, the large amount of geospatial data can only be managed in GIS-integrated digital maps. Thus, there is a need to implement modern solutions based on specialised hardware and software for the optimal management of this data. The direct beneficiaries of GIS-managed digital maps are the various specialist departments of local public administration to solve problems, issue solutions, make decisions and inform the population.

Digital maps are the pillar of urban, metropolitan or regional planning solutions. Efficient management of utility networks, which is best achieved through digital maps, should be seen as a concept underpinning urban development. The various projects that can be further developed in a GIS environment help to implement the necessary tools and procedures, e.g. for monitoring risks and disasters at local, regional or national level, minimising risks through forecasting simulations or modelling interventions. Up-to-date digital maps must provide the cartographic support needed for accurate localisation.

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[6]https://worldview.earthdata.nasa.gov/?v=-120.32076174614306,-46.546875,94.16451174614306,53.015625&t=2022-05-25-T13%3A03%3A35Z

[7]https://www.mapbox.com/

[8]https://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9

[9]https://livingatlas.arcgis.com/wayback/#active=5314&ext=-115.34940,36.03923,-115.24760,36.08877

[10]https://www.bing.com/maps

[11]https://www.here.com/

[12]https://www.planet.com/products/explorer/

[13]https://www.mapquest.com/

[14]https://www.google.ca/maps/dir/"//@45.744128,21.2338888,14z

[15]https://www.arcgis.com/home/item.html?id=de99b23e5b9a471bb92580b0ca89408e

[16]https://livingatlas2.arcgis.com/landsatexplorer/

[17]https://apps.sentinel-hub.com/sentinel-playground/?source=S2L2A&lat=40.4&lng=-3.730000000000018&zoom=12&preset=null&layers=&maxcc=20&gain=1.0&gamma=1.0&time=2021-11-01%7C2022-05-25&atmFilter=&showDates=false

[18]https://earthexplorer.usgs.gov/

[19]https://leafletjs.com/

[20]https://cesium.com/

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